# Srch3D: Efficient 3D Model Search via Online Manufacturing-specific Object Recognition and Automated Deep Learning-Based Design Classification

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- Rapid growth in additive manufacturing (AM) due to accessibility, customizability and affordability makes it possible for everyone to produce products using personal printers. Designs can be developed by consumers, if the consumers have knowledge of mechanical design and 3D modeling or obtained from third parties.

- The whole process starting from the CAD design, design to manufacturing translation and the 3D printing of the target component is often time-consuming requiring advanced knowledge and domain expertise that most current end-users lack.

- Lots of objects, which may be very similar or identical to what the non-technical user aims to design and print, are being produced by the expert in industry and hence billions of proven part designs already exist.

- This research fills the gap above by developing a domain-specific search engine for 3D models. It enables to search for components (and detect malicious defective designs) on a large repository of existing proven part designs efficiently.
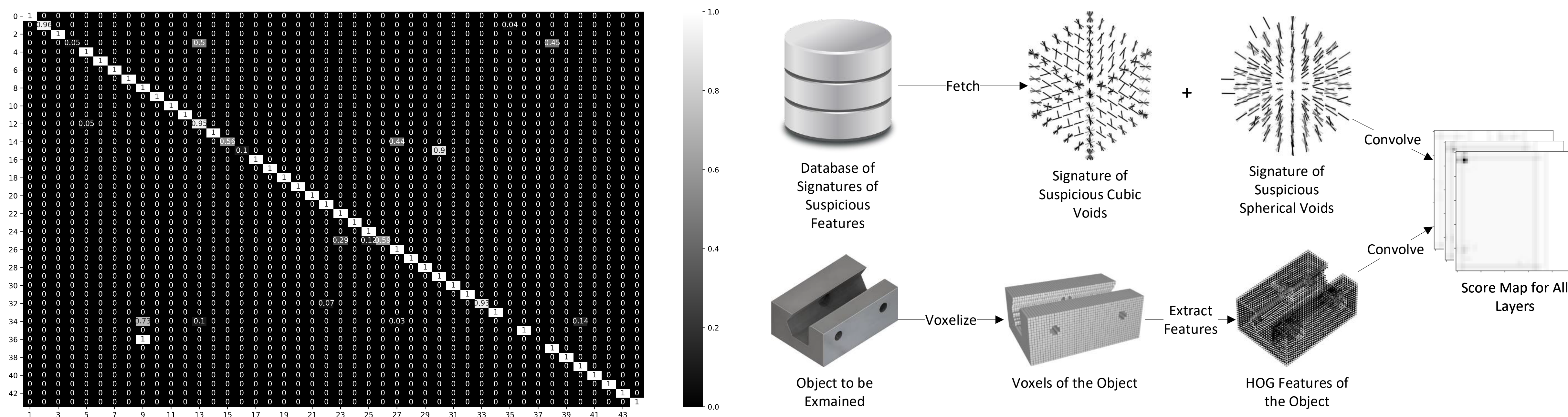
Automated Classification of 3D Designs.
We leverage deep learning to classify each individual design file into previously defined set of categories. The design files are first translated to different formats to increase the classification performance.

Malicious Defective Design Detection. We leverage machine learning solutions to search for and detect suspicious defective parts in a given design file. Our database includes potential defects that could impact the structural integrity of the designs.

Broader Impact

- Our techniques can enable efficient search capabilities by end-users to enable them find and print their target components without domain-specific knowledge.

- We have shown the impact of such malicious defects in PPEs and printed COVID masks that cannot be noticed by a naked eye. We have also proposed the corresponding defenses.

- PI Zonouz has worked with a female high school student (Sruthi Suresh) throughout regular meetings on related CPS Security topics. She is currently admitted to Cornell University to start in Fall 2021.